

PROJECTS

## TENSILE STRUCTURES AS UNIFYING ELEMENT

6 BEVIS MARKS

HIGHEST ALL-WEATHER ROOF GARDEN

“THE KEY”

A BUILDING AS A LAB

REPORT

TEXTILE ROOFS 2016 **BERLIN**



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# contents



## PROJECTS

PAGE

4 **Singapore** GARDENS BY THE BAY  
RETRACTABLE SHADING SCREENS  
FOR THE COOLED CONSERVATORY COMPLEX



5 **the Netherlands** TRANSFORMATION OF A BUSINESS PARK  
ETFE-SKYLIGHTS OF CENO TEC PROVIDE A  
NEW ATRIUM WITH LIGHT AND ATMOSPHERE

8 **Germany** DAY-CARE CENTER  
SUSTAINABILITY TO THE NEEDS OF CHILDREN

9 **Ecuador** TENSILE STRUCTURES AS UNIFYING ELEMENT  
CLIMATIC ENVELOPE  
FOR THE NEW HEAD OFFICE AND LEISURE FACILITIES

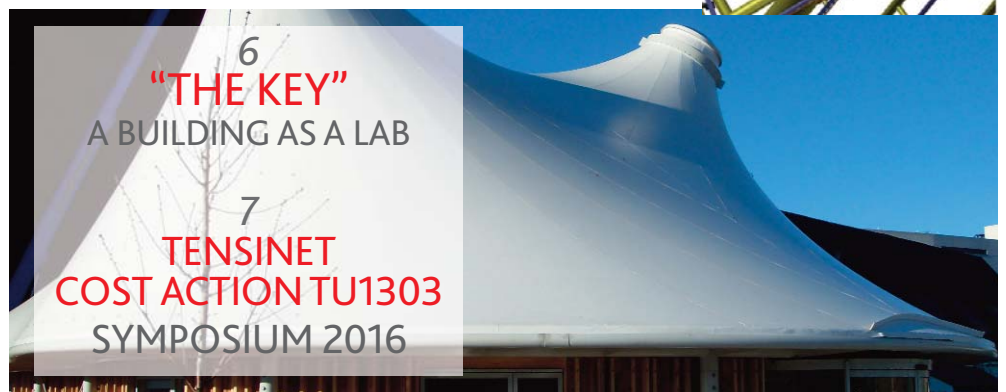
10 **UK** 6 BEVIS MARKS  
LONDON'S HIGHEST ALL-WEATHER ROOF GARDEN



17 **USA** TRANSPARANT ROOF FIRST SPORTS STADIUM IN THE USA  
WITH LIGHTWEIGHT ETFE FILM ROOF

18 **GERMANY** INNER COURTYARD ROOFING  
CUSTOM-FIT SITS THE CUSHION FOIL ROOF

19 **TURKEY** TRABZON AKYAZI STADIUM  
TEXTILE ROOF AND FACADE



6  
"THE KEY"  
A BUILDING AS A LAB

7  
TENSINET  
COST ACTION TU1303  
SYMPOSIUM 2016

## REPORT

12 **TEXTILE ROOFS 2016**  
BERLIN

## ANNOUNCEMENTS

7 RUBBERDESIGN COMPETITION 2016  
16 ESSENER MEMBRANBAU SYMPOSIUM 2016 30 SEPTEMBER 2016  
20 TECHTEXTIL 9-12 MAI 2017

# Edito

Dear Reader,

We are now only one month away from the next TensiNet Symposium, which will be held together with the Cost Action TU1303. The symposium will take place at Newcastle University, from the 26th till the 28th of October 2016, see also <http://conferences.ncl.ac.uk/tensinet2016>. The theme of the symposium is Novel Structural Skins, the same as the COST Action. More than 70 presentations cover a wide spectrum of the five main topics, and include also a good mix of interesting keynote speakers. On Wednesday 26th of October 2016 in the afternoon takes place the open session with the focus on built projects. We invite architects, engineers and professionals to learn more about structural skins and the recent development.

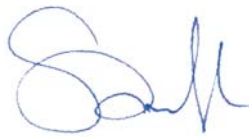
This issue of TensiNews contains, as a preview of the symposium, an article from Carl Maywald who is one of our keynote speakers, and an article about the project the Key in Newcastle, which can be visited during the symposium.

We present in this TensiNews another variety of new foil and membrane projects. An ETFE roof over an atrium in the Netherlands is presented, as well as the first stadium in the United States with ETFE, and an ETFE roof covering a courtyard in Germany. The environmental opportunities using membranes present articles about retractable shading screens in Singapore, a climatic envelope in Ecuador and the membrane roof for a day care centre in Germany. Still under construction, the new Trabzon stadium in Turkey is presented.

The 21st Textile Roofs workshop took place this May in Berlin. Many TensiNet members were present with their presentations. We are glad that Joseph Llorens was so kind to write again a summary of this event for us.

We look forward to seeing you all in Newcastle on our TensiNet / COST Action TU1303 symposium, and on other tensile structures related events this autumn. Please enjoy in the short meantime this issue of TensiNews.

Yours sincerely,  
Bernd Stimpfle



## Forthcoming Events

**IASS 2016** *Spatial Structures in the 21<sup>st</sup> Century*

Tokyo, Japan • 26-30/09/2016

<http://iass2016.jp/>

**3th Essener Membranbau Symposium 2016**

University of Duisburg-Essen, Essen • 30/09/2016

<http://www.uni-due.de/iml/>

**TENSINET - COST ACTION TU1303 SYMPOSIUM 2016**

*Novel structural skins*

Newcastle, UK 26-29/10/2016

<http://conferences.ncl.ac.uk/tensinet2016/>

**10th Aachen-Dresden International Textile Conference 2015**

Aachen, Germany • 24-25/11/2016

<http://www.aachen-dresden-denkenhof.de/en/itc/>

**Techtextil 2017**

Frankfurt am Main, Germany • 9-12/05/2017

<https://techtextil.messefrankfurt.com>

**Textile Roofs 2017**

Archenhold Observatory, Berlin, Germany 15-17/05/2017

[www.textile-roofs.com](http://www.textile-roofs.com)

## Forthcoming Meetings

**Partner Meeting 2 and Annual General Meeting**

Thursday 27 October, 18.45 - 19.45

Newcastle University, Great North Museum Hancock

<http://conferences.ncl.ac.uk/tensinet2016/>

## Multihalle Mannheim, Germany FREI OTTO'S PIONEERING PIECE OF STRUCTURAL DESIGN NEEDS YOUR ATTENTION. SAVE THIS UNIQUE AND LARGE GRID SHELL BUILDING!



© Hubert Berberich

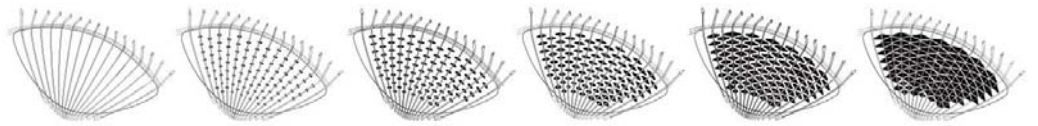
The council of Mannheim decided last June to demolish this unique grid shell building unless, by the end of 2017, means of federal, state and private initiatives (crowdfunding, donations and grants) are found for the renovation. The Multihalle is a very important building in the history of lightweight structures and especially for so called grid shells.

The city of Mannheim, heavily destroyed during WWII, started a slow post-war reconstruction phase. The Multihalle building, originally constructed as a pavilion in 1974 for the biennial horticulture show "Bundesgartenschau" was part of this larger redevelopment. The architects Carlfried Mutschler and Winfried Langner engaged Frei Otto as consulting engineer for the design of the roof. Frei Otto designed an extraordinary ingenious grid shell with a large span of 60x60m.

To give this unusual sensitive form enough stiffness 4 layers of wooden laths were

placed one above the other to form a three-dimensional grid. Joining was complex as during the erection process the grid has to rotate into its final organic shape. Pinned connections were needed to enable this rotations. Once the final form was achieved the pin joints were bolted.

Originally the pavilion was designed as a temporary construction, as often is the case for exhibition facilities. A first renovation took place beginning of the '80s when the PVC film was replaced. Meanwhile the membrane became porous and the timber construction damaged. In 2008 a large scaffold was constructed to stabilize the construction. Finally Multihalle was closed in 2011. The building is on the Heritage conservation list since 1998. Harald Voigt from Tentum GmbH brought under attention the fact that we should react to counter the demolition and find a way to preserve the building!



1

# GARDENS BY THE BAY

Singapore

## RETRACTABLE SHADING SCREENS FOR THE COOLED CONSERVATORY COMPLEX

### Introduction

In 2006, Wilkinson Eyre architects were part of a British-led team that won the design competition for one of the most ambitious cultural projects of recent years – the masterplan for Singapore’s Gardens by the Bay. The project, comprising three separate gardens covering a total of 101 hectares was central to the government’s visionary plan to transform the city-state into a City-in-a-Garden. Wilkinson Eyre’s brief was to design an architectural icon, a horticultural attraction and a showcase for sustainable technology at the heart of the Gardens at Bay South. Their response was the Cooled Conservatory Complex.

The two main conservatory structures are among the largest climate-controlled glasshouses in the world, covering an area in excess of 20.000m<sup>2</sup>, and showcase the flora of those environments most likely to be affected by climate change:

- **Flower Dome:** which recreates the conditions in Mediterranean spring time (the cool-dry Mediterranean zone) with a surface of 1.2 hectare and a height of 38m);
- **Cloud Forest:** which emulates the conditions of tropical highlands (the cool-wet tropical montane) with a surface of 0.8 hectare and a height of 58m.)



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The challenge of creating these conservatory environments under glass was a fundamental driver of the design, which was brought about through a uniquely collaborative relationship between Wilkinson Eyre and the other members of the multidisciplinary team: masterplanner Grant Associates, structural engineer, Atelier One and environmental specialists Atelier Ten. Each conservatory has a composite structure composed of a gridshell, which works in tandem with an external superstructure of radially arranged, arched steel ribs. These were introduced primarily to address the lateral loads to the gridshell, although they also give the conservatories their distinctive

organic identity. (information <http://www.wilkinsoneyre.com/projects/cooled-conservatories-gardens-by-the-bay>) Gardens by the Bay is a project that has been awarded not only a Platinum rating in the Green Mark For Parks scheme (Singaporean equivalent of LEED), but also a World Building of the Year 2012 award at the World Architecture festival (WAF) and in 2013 the project received the prestigious RIBA Lubetkin Prize.

### Soltis 92 screens

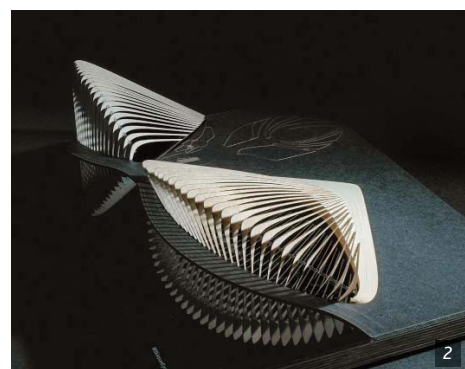
Screens made by Serge Ferrari were chosen to realise a retractable sun protection system. In total the conservatories Flower

Dome and Cloud Forest benefit from an external solar protection system that is every bit as exceptional with its 25.000m<sup>2</sup> of Soltis 92 screens.

The conservatories feature astonishing specific characteristics:

- Maintain the high light levels required by the plants within, while minimizing the associated solar heat gain inevitable in Singapore’s tropical climate;
- Dynamic nature of the completed building, with shades opening and closing in response to the changing solar environment;
- Distinct curved forms of the biomes generated from the geometry of a hyperbolic curve and

Name of the project:	retractable shading screens for the Gardens by the bay
Year of construction:	2012
Architect:	Wilkinson Eyre Architects
Local Implementing Architects:	CPG Consultants Pte Ltd
Structural Engineers:	Atelier One
Building Services Consulting Engineer:	Atelier Ten
Consulting Engineer:	Wade Consulting
General Contractor:	Woh Hup Pte Ltd
Manufacturer membrane:	Advance Canvas
Fabric - Serge Ferrari composite screens:	Soltis 92-2051
Screen area:	25.000m <sup>2</sup>



2

Figure 1. Open versus closed configuration of the shading screens © Wilkinson Eyre architects  
Figure 2. Model Cooled Conservatory Complex - Flower Dome and Cloud Forest © Wilkinson Eyre architects  
Figures 3 to 6. Shading screens seen from above and beneath © Serge Ferrari